Total solder points: 775
Difficulty level:
beginner 1☐ 2☐ 3☐ 4☐ 5☑ *advanced*

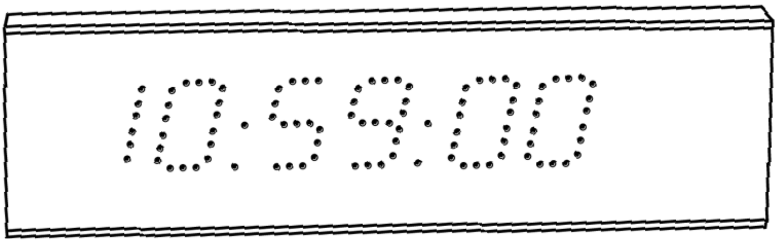
HIGH-Q velleman-kit

Multifunctional clock display

Features :

K8009

- ☑ **6 x 36mm high digits.**
- ☑ **Time, date & temperature indication, selectable with toggle option.**
- ☑ **1 sec. resolution chronometer with lap function.**
- ☑ **Count down function to a specific date.**
- ☑ **Scoreboard function (two players or teams, count up to 199).**
- ☑ **Random generator from 00 to 99.**
- ☑ **2 digit dice.**
- ☑ **Hour chime option.**
- ☑ **Counter display.**
- ☑ **Relay output for temperature control or time alarm.**
- ☑ **US or Europe display option: time, date, degrees Celsius or Fahrenheit.**
- ☑ **Wireless remote control for all functions (wired remote possible).**
- ☑ **Optional enclosure type B8009.**
- ☑ **Optional extra remote type K6706A, K6706B or K6706G.**





Specifications :

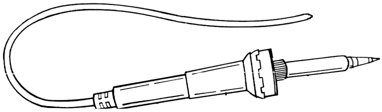
- Fixed 433.92 MHz transmitter frequency, as required by law.
- Key chain remote control included.
- Temperature indication from -20 to +70 ºC (resolution 1º).
- Temperature indication from 0 to +150 ºF (resolution 2º).
- Memory backup option: 9V battery or rechargeable battery T331
- Relay output: 1A / 24V max.
- Supply: 12VDC/300mA power supply (adapter type PS1203).
- Dimensions : 252 x 80mm (without enclosure).

Modifications reserved

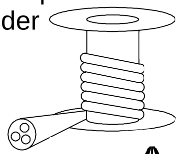
1. Assembly (Skipping this can lead to troubles !)

Ok, so we have your attention. These hints will help you to make this project successful. Read them carefully.

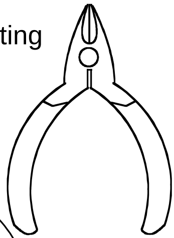
1.1 Make sure you have the right tools:



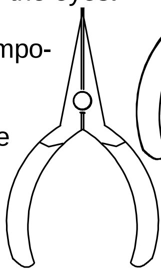
- A good quality soldering iron (25-40W) with a small tip.
- Wipe it often on a wet sponge or cloth, to keep it clean; then apply solder to the tip, to give it a wet look. This is called ‘thinning’ and will protect the tip, and enables you to make good connections. When solder rolls off the tip, it needs cleaning.



- Thin raisin-core solder. Do not use any flux or grease.
- A diagonal cutter to trim excess wires. To avoid injury when cutting excess leads, hold the lead so they cannot fly towards the eyes.

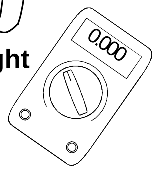


- Needle nose pliers, for bending leads, or to hold components in place.



- Small blade and phillips screwdrivers. A basic range is fine.

For some projects, a basic multi-meter is required, or might be handy

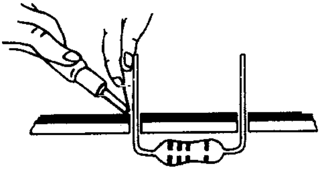


1.2 Assembly Hints :

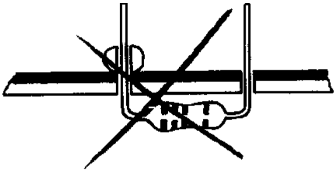
⇒ Make sure the skill level matches your experience, to avoid disappointments.
⇒ Follow the instructions carefully. Read and understand the entire step before you perform each operation.
⇒ Perform the assembly in the correct order as stated in this manual
⇒ Position all parts on the PCB (Printed Circuit Board) as shown on the drawings.
⇒ Values on the circuit diagram are subject to changes.
⇒ Values in this assembly guide are correct*
⇒ Use the check-boxes to mark your progress.
⇒ Please read the included information on safety and customer service

* Typographical inaccuracies excluded. Always look for possible last minute manual updates, indicated as ‘NOTE’ on a separate leaflet.

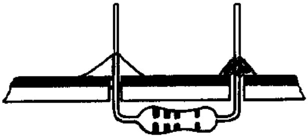
1.3 Soldering Hints :



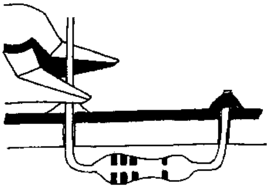
1- Mount the component against the PCB surface and carefully solder the leads



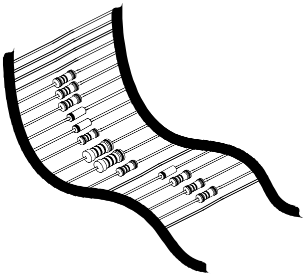
2- Make sure the solder joints are cone-shaped and shiny



3- Trim excess leads as close as possible to the solder joint



AXIAL COMPONENTS ARE TAPED IN THE CORRECT MOUNTING SEQUENCE !

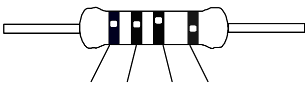


REMOVE THEM FROM THE TAPE ONE AT A TIME !

Velleman hereby certifies that the device K8009 meets the essential requirements and all other relevant stipulations of directive 1999/5/EG and 1995/5/EC.

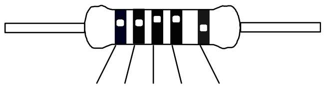
For the complete conformity declaration check out : http://www.velleman.be/downloads/doC/CE_K8009.pdf

5%



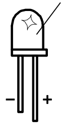
4K7= (4 - 7 - 2 - B)

1%



4K7= (4 - 7 - 0 - 1 - 1)

COLOR= 2... !



	I	P	E	SF	S	DK	N	D	GB	F	NL	
CODE	*CODICE COLORE*	*CODIGO DE CORES*	*CODIGO DE COLORES*	*VÄRI KOODI*	*FÄRG SCHEMA*	*FARVE-KODE*	*FARGE-KODE*	*FARB KODE*	*COLOUR CODE*	*CODIFI-CATION DES COU-LEURS*	*KLEUR KODE*	CODE
0	Nero	Preto	Negro	Musta	Svart	Sort	Sort	Schwarz	Black	Noir	Zwart	0
1	Marrone	Castanho	Marrón	Ruskea	Brun	Brun	Brun	Braun	Brown	Brun	Bruin	1
2	Rosso	Encar-nado	Rojo	Punainen	Röd	Rød	Rød	Rot	Red	Rouge	Rood	2
3	Aran-ciato	Laranja	Naran-jado	Oranssi	Orange	Orange	Orange	Orange	Orange	Orange	Oranje	3
4	Giallo	Amarelo	Amarillo	Keltainen	Gul	Gul	Gul	Gelb	Yellow	Jaune	Geel	4
5	Verde	Verde	Verde	Vihreä	Grön	Grøn	Grønn	Grün	Green	Vert	Groen	5
6	Blu	Azul	Azul	Sininen	Blå	Blå	Blå	Blau	Blue	Bleu	Blauw	6
7	Viola	Violeta	Morado	Purppura	Lila	Violet	Violet	Violet	Purple	Violet	Paars	7
8	Grigio	Cinzento	Gris	Harmaa	Grå	Grå	Grå	Grau	Grey	Gris	Grijs	8
9	Bianco	Branco	Blanco	Valkoinen	Vit	Hvid	Hvidt	Weiss	White	Blanc	Wit	9
A	Argento	Prateado	Plata	Hopea	Silver	Sølv	Sølv	Silber	Silver	Argent	Zilver	A
B	Oro	Dourado	Oro	Kulta	Guld	Guld	Guldl	Gold	Gold	Or	Goud	B

IMPORTANT

First the remote control PCB is assembled, P6706A:

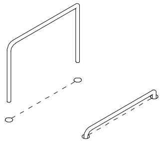
The remote control can be build for wireless remote operation or for “wired” remote operation (no need for battery in the transmitter). In case of a wired remote, only a few components are mounted, see further.

Before mounting the components on the PCB, first check that the PCB fits in the housing. Watch the small notch next to LD1. Should it not fit, then grind the edges of the PCB carefully.

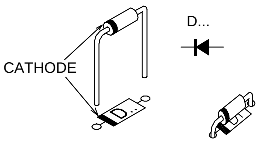
Mount only the components marked with “#” if wired remote is wanted.

1. Jumperwire

❑ J1 #

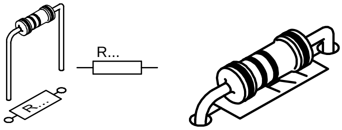


2. Diodes (Check the polarity)



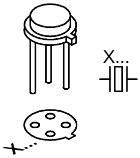
❑ D1 : BAT85 #
❑ D2 : BAT85 #

3. 1/4W Resistors



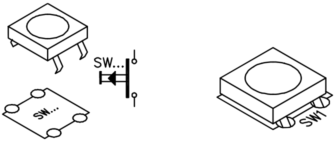
❑ R4 : 33K (3 - 3 - 3 - B)
❑ R5 : 100K (1 - 0 - 4 - B) #

4. SAW resonator (Watch the position of the notch)



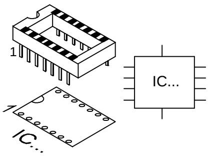
❑ X1 : SAW433

5. Push buttons



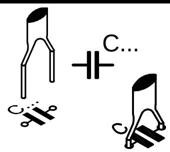
❑ SW1 : KRS0611 #
❑ SW2 : KRS0611 #

6. IC socket (Watch the position of the notch)



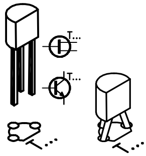
❑ IC1 : 18p #

7. Capacitors



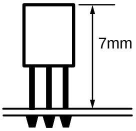
❑ C1 : 100pF (101)
❑ C2 : 1pF small type !
❑ C3 : 56pF
❑ C4 : 4,7pF (4p7, 4.7)
❑ C5 : 56pF
❑ C6 : 470pF (471) #

8. Transistor

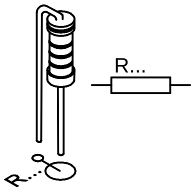


❑ T1 : MPSH10

Check the minimum height ! :

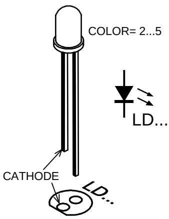


9. 1/4W Resistors (check the color code)



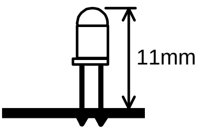
❑ R1 : 33K (3 - 3 - 3)
❑ R2 : 47 (4 - 7 - 0)
❑ R3 : 220 (2 - 2 - 1)

10. LED (check the polarity)

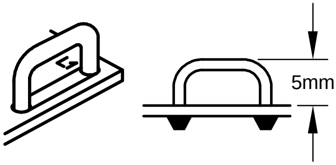


❑ LD1 : 3mm (2)

Mount at the indicated height :



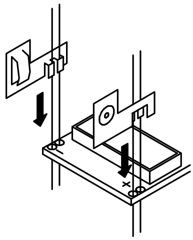
11. Coil



A simple air core coil has to be made as shown in the diagram using the jumper lead supplied

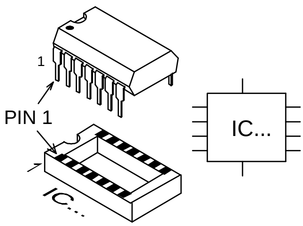
❑ L1: 1 turn

12. Battery contacts



Check for good attachment of the solder to the contacts.
Mount them as straight as possible!

13. IC (Watch the position of the notch !)



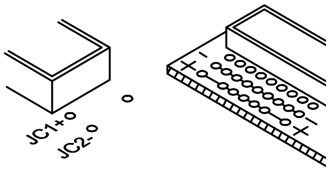
❑ IC1 : UM3758 #

14. Create your code

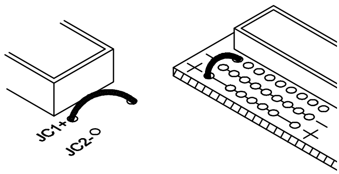
Your own individual code can be set for a transmitter/clock combination. There is a row of nine code pads that are the closest to IC1, only one code connection is used. The code can be set by linking the code pad to a neighbouring "-" pad or "+" pad by using a jumper lead. JC1 and JC2 are located on the ***main PCB P8009***.

There are 3 different combinations possible:

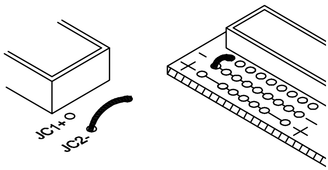
1. JC1 and JC2 are not mounted on the main PCB, then do not mount code jumpers on the transmitter.



2. JC1 is mounted on the main PCB, Mount a jumper like in the drawing:



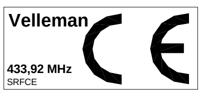
3. JC2 is mounted on the main PCB, Mount a jumper like in the drawing:



In case of a “**wired**” remote, continue the assembly.
In case of a wireless remote, the transmitter PCB can be placed in his enclosure.
Fit a new 12V battery type V23GA or GP23A. Check the polarity which is shown in the enclosure.
REMARK: If the buttons do not “click”, please check the position of the PCB. It is also possible that the first time, you have to press firmly the button cap before they work properly.

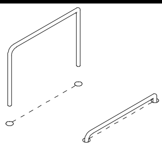
15. Sticker

Affix the supplied sticker to the housing.



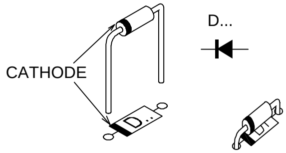
Assembly of the main PCB P8009 :

1. Jumperwires



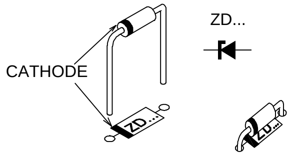
- ❑ J1
- ❑ J2
- ❑ J3
- ❑ J4
- ❑ J5
- ❑ J6
- ❑ J7
- ❑ J8
- ❑ J9
- ❑ J10
- ❑ J11
- ❑ J12
- ❑ J13
- ❑ J14
- ❑ J15
- ❑ J16
- ❑ J17
- ❑ J18
- ❑ J19
- ❑ J20
- ❑ J21
- ❑ J22
- ❑ J23
- ❑ J24
- ❑ J25
- ❑ J26
- ❑ J27
- ❑ J28
- ❑ J29
- ❑ J30
- ❑ J31
- ❑ J32
- ❑ J33
- ❑ J34
- ❑ J35
- ❑ J36
- ❑ J37
- ❑ J38
- ❑ J39
- ❑ J40
- ❑ J41
- ❑ J42
- ❑ J43
- ❑ J44
- ❑ J45
- ❑ J46
- ❑ J47

2. Diodes (Check the polarity)



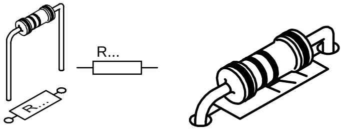
- ❑ D1 : 1N4007
- ❑ D2 : 1N4148
- ❑ D3 : 1N4148
- ❑ D4 : BAT85
- ❑ D5 : BAT85
- ❑ D6 : 1N4148
- ❑ D7 : 1N4148
- ❑ D8 : 1N4148
- ❑ D9 : 1N4148

3. Zener diode (Check the polarity)



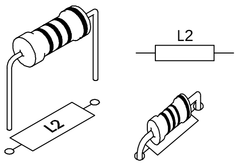
- ❑ ZD1 : 6V2
- ❑ ZD2 : 3V3
- ❑ ZD3 : 4V7
- ❑ ZD4 : 4V3
- ❑ ZD5 : 5V1
- ❑ ZD6 : 9V1

4. 1/4W Resistors



❑ R1 : 100K (1 - 0 - 4)
❑ R2 : 270 (2 - 7 - 1)
❑ R3 : 270 (2 - 7 - 1)
❑ R4 : 4K7 (4 - 7 - 2)
❑ R5 : 270 (2 - 7 - 1)
❑ R6 : 5K6 (5 - 6 - 2)
❑ R7 : 2K7 (2 - 7 - 2)
❑ R8 : 2K2 (2 - 2 - 2)
❑ R9 : 10K (1 - 0 - 3)
❑ R10 : 100K (1 - 0 - 4)
❑ R11 : 10K (1 - 0 - 3)
❑ R12 : 4K7 (4 - 7 - 2)
❑ R13 : 10K (1 - 0 - 3)
❑ R14 : 100K (1 - 0 - 4)
❑ R15 : 47K (4 - 7 - 3)
❑ R16 : 2K2 (2 - 2 - 2)
❑ R17 : 150 (1 - 5 - 1)
❑ R18 : 100K (1 - 0 - 4)
❑ R19 : 4K7 (4 - 7 - 2)
❑ R20 : 10K (1 - 0 - 3)
❑ R21 : 270 (2 - 7 - 1)
❑ R22 : 100K (1 - 0 - 4)
❑ R23 : 100K (1 - 0 - 4)
❑ R24 : 270 (2 - 7 - 1)
❑ R25 : 270 (2 - 7 - 1)
❑ R26 : 100K (1 - 0 - 4)
❑ R27 : 100K (1 - 0 - 4)
❑ R28 : 100K (1 - 0 - 4)
❑ R29 : 100K (1 - 0 - 4)
❑ R30 : 100K (1 - 0 - 4)
❑ R31 : 100K (1 - 0 - 4)
❑ R32 : 4K7 (4 - 7 - 2)
❑ R33 : 10K (1 - 0 - 3)
❑ R34 : 270 (2 - 7 - 1)
❑ R35 : 270 (2 - 7 - 1)
❑ R36 : 100K (1 - 0 - 4)
❑ R37 : 4K7 (4 - 7 - 2)
❑ R38 : 10K (1 - 0 - 3)
❑ R39 : 100K (1 - 0 - 4)
❑ R40 : 100K (1 - 0 - 4)
❑ R41 : 100K (1 - 0 - 4)
❑ R42 : 10K (1 - 0 - 3)
❑ R43 : 10K (1 - 0 - 3)
❑ R44: 10K (1 - 0 - 3)
❑ R45 : 10K (1 - 0 - 3)
❑ R46 : 10K (1 - 0 - 3)
❑ R47 : 4K7 (4 - 7 - 2)
❑ R48 : 100K (1 - 0 - 4)
❑ R49 : 560 (5 - 6 - 1)
❑ R50 : 100K (1 - 0 - 4)
❑ R51 : 2K2 (2 - 2 - 2)
❑ R52 : 4K7 (4 - 7 - 2)
❑ R53 : 2K2 (2 - 2 - 2)
❑ R54 : 2K2 (2 - 2 - 2)
❑ R55 : 1K (1 - 0 - 2)
❑ R56 : 1K (1 - 0 - 2)
❑ R57 : 6M8 (6 - 8 - 5)
❑ R58 : 6K8 (6 - 8 - 2)
❑ R59 : 18K (1 - 8 - 3)
❑ R60 : 270 (2 - 7 - 1)
❑ R61 : 33K (3 - 3 - 3)
❑ R62 : 18K (1 - 8 - 3)
❑ R63 : 10K (1 - 0 - 3)
❑ R64 : 10K (1 - 0 - 3)
❑ R65 : 5K6 (5 - 6 - 2)
❑ R66 : 2K7 (2 - 7 - 2)
❑ R67 : 100K/1% (1 - 0 - 0 - 3)
❑ R68 : 270K/1% (2 - 7 - 0 - 3)

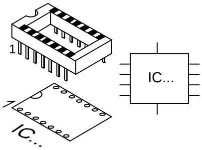
5. Axial coil



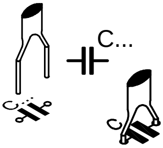
❑ L1 : 1µH (1 - 0 - B)

6. IC socket (Watch the position of the notch)

- ❑ IC1 : 8p
- ❑ IC2 : 18p
- ❑ IC3 : 18p
- ❑ IC4 : 18p
- ❑ IC5 : 16p
- ❑ IC6 : 8p

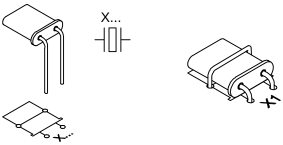


7. Capacitors



- ❑ C1 : 470pF (471)
- ❑ C2 : 470pF (471)
- ❑ C3 : 100nF (104, µ1)
- ❑ C4 : 100nF (104, µ1)
- ❑ C5 : 100nF (104, µ1)
- ❑ C6 : 2pF (2.2, 2p2)
- ❑ C7 : 12pF
- ❑ C8 : 330pF (331)
- ❑ C9 : 330pF (331)
- ❑ C10 : 22pF
- ❑ C11 : 330pF (331)
- ❑ C12 : 1pF
- ❑ C13 : 2pF
- ❑ C14 : 82pF
- ❑ C15 : 330pF (331)
- ❑ C16 : 100nF (104, µ1)

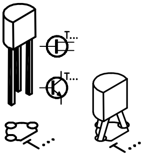
8. Quartz crystal



- ❑ X1 : 4.194304

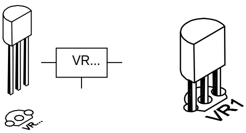
Fix the quartz crystal by means of a jumpwire.

9. Transistors



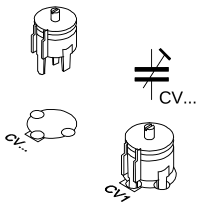
- ❑ T1 : BC547C
- ❑ T2 : BC547C
- ❑ T3 : BC547C
- ❑ T4 : BC547C
- ❑ T5 : BC547C
- ❑ T6 : BC547C
- ❑ T7 : BC547C
- ❑ T8 : BC547C
- ❑ T9 : BC547C
- ❑ T10 : BC547C
- ❑ T11 : BC547C
- ❑ T12 : BC547C
- ❑ T13 : BC547C
- ❑ T14 : BC547C
- ❑ T15 : BC547C
- ❑ T16 : BC547C
- ❑ T17 : BC557
- ❑ T18 : BC557
- ❑ T19 : BC557
- ❑ T20 : BC557
- ❑ T21 : BC557
- ❑ T22 : BC557
- ❑ T23 : BC557
- ❑ T24 : BF199

10. Voltage regulator

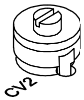


- ❑ VR1 : 78L05

11. Trim capacitors

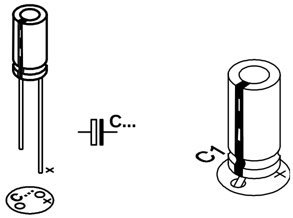


❑ CV1 :Trim 22p (Green)

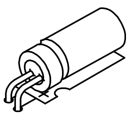


❑ CV2 : TRIM 5p5

12. Electrolytic capacitors

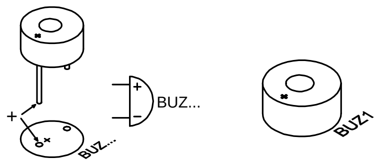


❑ C17 : 1µF
❑ C18 : 100µF / 16V
❑ C19 : 1µF
❑ C20 : 10µF
❑ C21 : 1µF



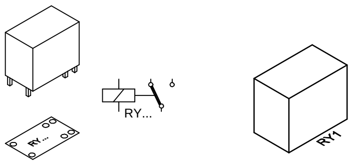
❑ C22 : 470µF / 25V

13. Buzzer (check the polarity)



❑ BUZ1 : SV4 / 12-S

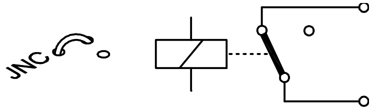
14. Relay



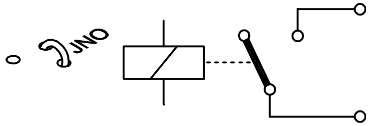
❑ RY1 : VR3D121C

A selection is possible for a normal **closed** contact output, or a normal **open** contact output :

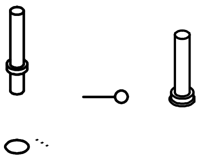
For normal closed, mount jumper **JNC:**



For normal open, mount jumper **JNO:**



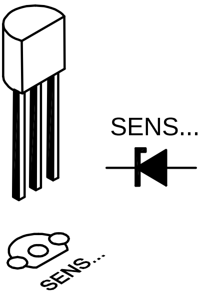
15. PCB pin. Mount only if you have access to a frequency counter.

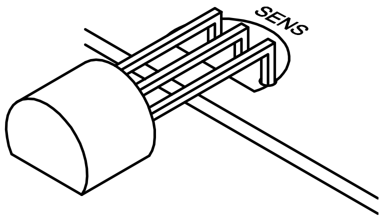


❑ GND
❑ Testpin for time calibration 15.625ms (64Hz)

This testpin can be used to calibrate the clock (see chapt. 22) by means of a counter.
Adjust CV1 for a period measurement of 15.625ms or 64Hz frequency.

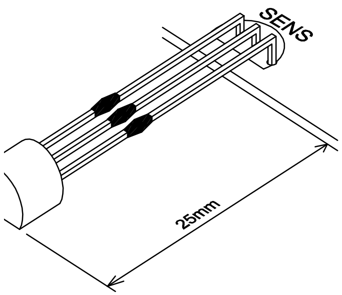
16. Temperature sensor





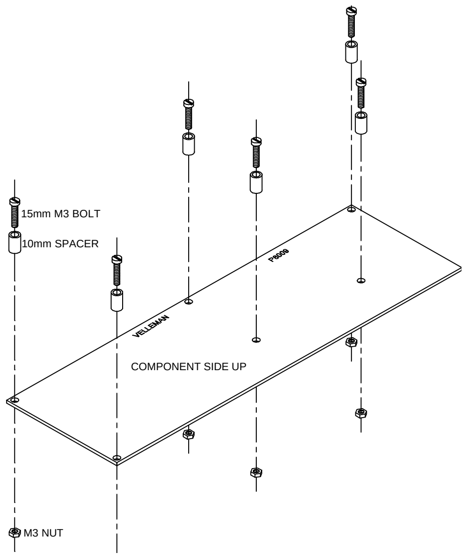
❑ SENS: LM335

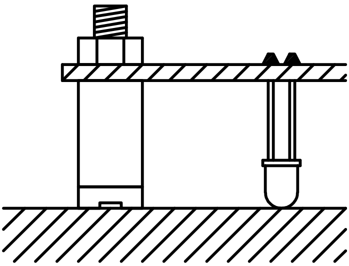
Make the connections longer when using an enclosure like our optional enclosure type B8009 (use blank jumpwires)



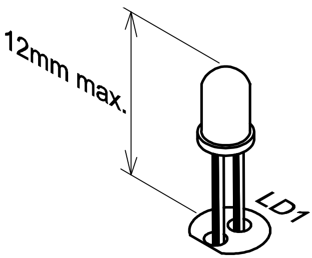
17. LED mounting

To mount all the LED's at the same hight, we are going to use some spacers.
Mount the spacers on the PCB:





Mount about five LED's, then turn over the PCB and solder ONE connection of each LED. Now correct the position of the LED's and solder the other connection of each LED.
Continue mounting all the LED's as above.

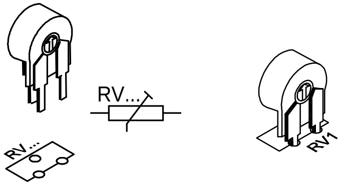


It is important that when our optional enclosure B8009 is used, that the maximum hight is respected !

❑ LD1… LD132: 3mm LED.

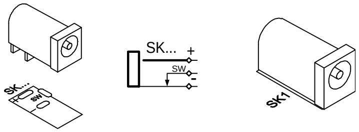
Now the spacers can be removed.

18. Resistor trimmer

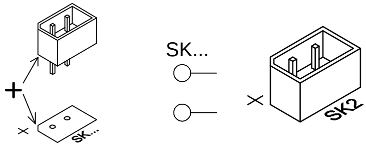


❑ RV1 : 500E (470)

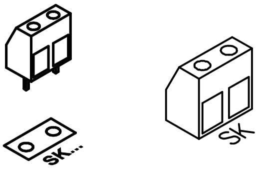
19. Connectors



❑ SK1 : DJ005

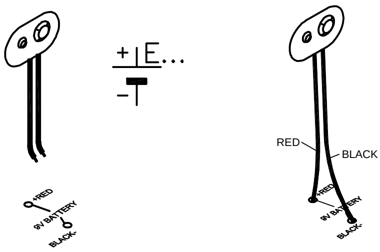


❑ SK2 : BATCON



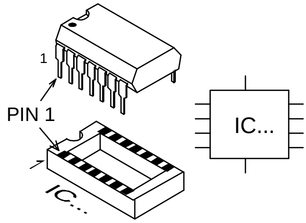
❑ SK3 : SCREW02

If a 9V block battery is used for the memory backup, then the following snap can be connected:



Check the polarity !

20. IC's (Watch the position of the notch !)

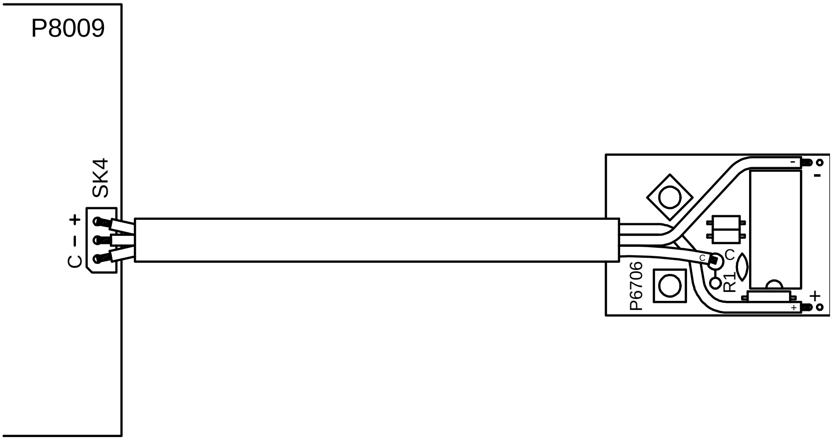


❑ IC1 : CA3160
❑ IC2 : VK8009 (PIC16C715)
❑ IC3 : UM3758
❑ IC4 : UM3758
❑ IC5 : CD4017
❑ IC6 : LM258

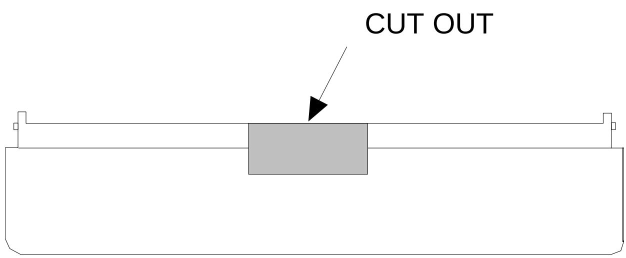
21. Connecting the wired remote control

Only three wires are used to connect the transmitter with the display.

- ❑ Connect one wire between the + from the display and the + of the transmitter (connection next to R5)
- ❑ Connect one wire between the - from the display and the - of the transmitter (connection next to C5)
- ❑ Connect one wire between C on the display and the connection at R1 on the transmitter (see drawing).



Before mounting the transmitter PCB in the enclosure, make a small slot in the bottom enclosure to pass the wires.



Now the transmitter can be placed in his enclosure.

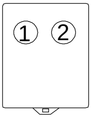
☝ **REMARK:** If the buttons do not "click", please check the position of the PCB. It is also possible that the first time, you have to press firmly the button cap before they work properly.

22. Test and adjustment

First we will test if the display works properly:

- Connect a 12VDC / 300mA adapter (check the polarity and the connector type) to the display. The display should indicate the time **00:00:00** (HH:MM:SS) and the (HH) should blink.

Next step is adjusting the displays- receiver to the transmitter. (skip this step if a wired transmitter is used).



>Remote control button code.

- Hold the transmitter about one meter (one yard) away from the display.
- Press button **1** on the transmitter, the LED on the transmitter should blink rapidly.
- Now adjust the trimmer capacitor CV2 (RECEIVER ADJUST) on the display using the supplied plastic tuning screwdriver, until the receiver LED (REC), blinks at the same rate as the transmitter.
- If a maximum range between transmitter - display is wanted, then it is advisable to repeat the above adjustment with the transmitter at about 10m (10 yard).
- If the adjustment is OK, then the HH of the display should increase each time button **1** is pressed.

☝ **Remark :** Hold the display away from large metal objects.

Next step is to calibrate the temperature indication :

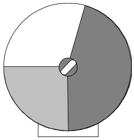
- Disconnect the power supply from the display.
- Reconnect the power supply to the display.
- Put a known good thermometer next to the display temperature sensor.
- Press repeatedly button **2** on the transmitter until the display shows **dAtE** blinking.
- Now press button **1** until **rEGIOn** is blinking.
- Next press button **2**, **Eu** will blink. Use button **1** to choose between **Eu** (Europe) or **uS** (USA) display format for time, date and temperature.
- Confirm your choice by pressing button **2**.
- Now press the left button until **dEGrEE** is displayed and confirm with button **2**.
- Now adjust the trim potentiometer RV1 (TEMP. CALIBRATION) until the displayed temperature corresponds with the “reference” thermometer.

☝ Repeat the above adjustment after the display is warmed up for a few hours.

Next step is to calibrate the clock time base

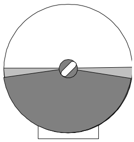
The processor has an internal oscillator that is used to run the clock.
By means of CV1(TIME CALIBRATION), it is possible to adjust the oscillator frequency if the clock does not run correctly.

1. Start by setting the trim capacitor in his center (50% overlap) position:



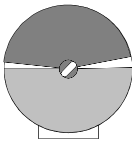
50%

2. should the clock run too fast, then turn the capacitor more in the maximum (100% overlap) direction:



100%

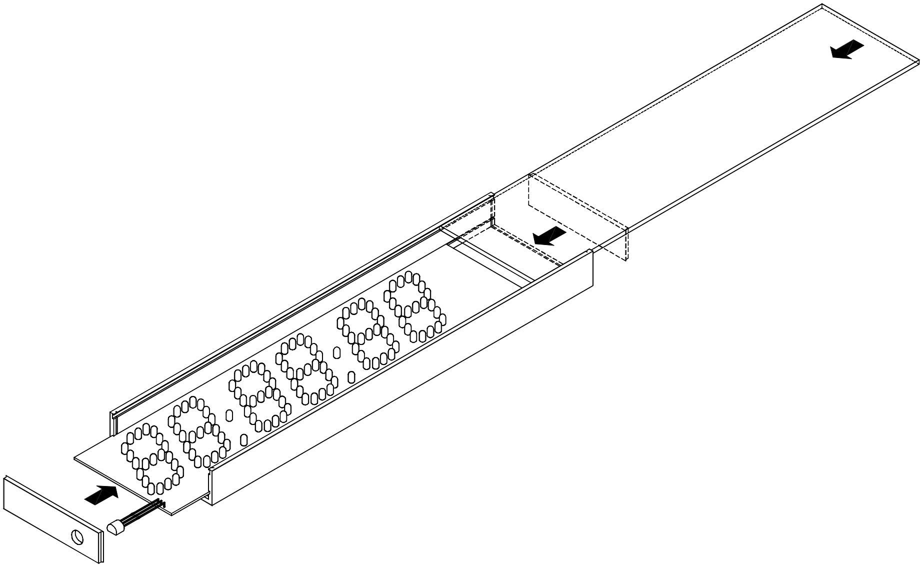
3. should the clock run too slow, then turn the capacitor more in the minimum (no overlap) direction:



0%

23. Mounting the display into the optional enclosure B8009

- Remove the display window and the side panels from the enclosure.
- Slide the PCB into the lower slot of the enclosure.
- At the left hand side two holes must be made in the small cover, one for the power supply plug*, and one for the temperature sensor.
  * Alternatively a hole can be made at the back of the enclosure to pass the power supply plug.
- Mount the two side panels.
- At the right hand side there is space for a battery, a 9V battery or a 3.6V re-chargeable battery type T331 can be used. Connect the battery to the appropriate connector.



After connecting the power supply plug, the display window can be mounted.

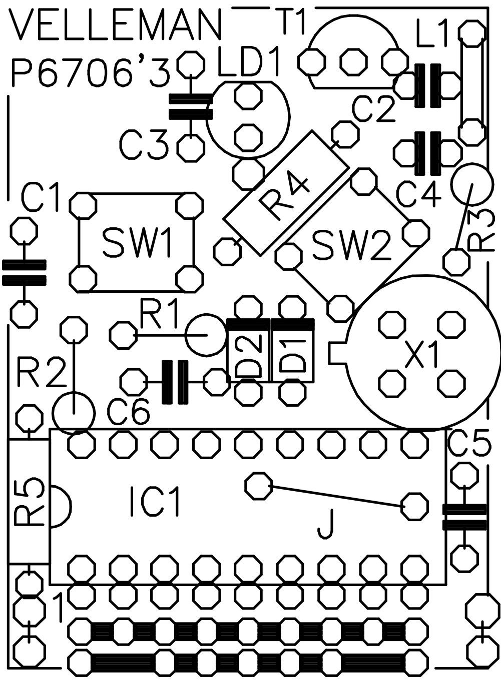
☝ **REMARK :** It is important that the temperature sensor body is outside the enclosure otherwise the temperature readout will be faulty.

☝ Keep the display out of direct sunlight.

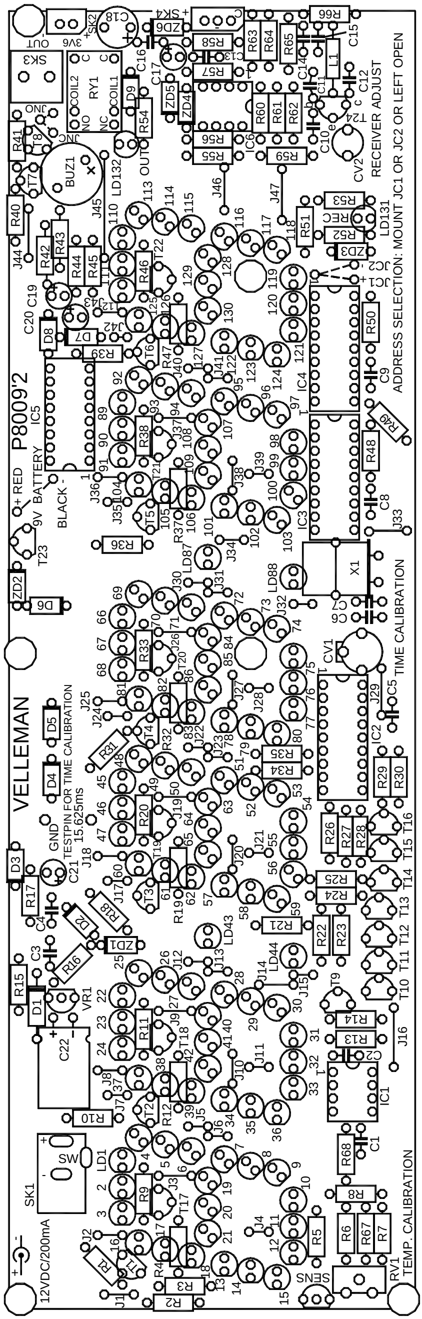
See the user manual for further instructions.

PCB
&
DIAGRAMS

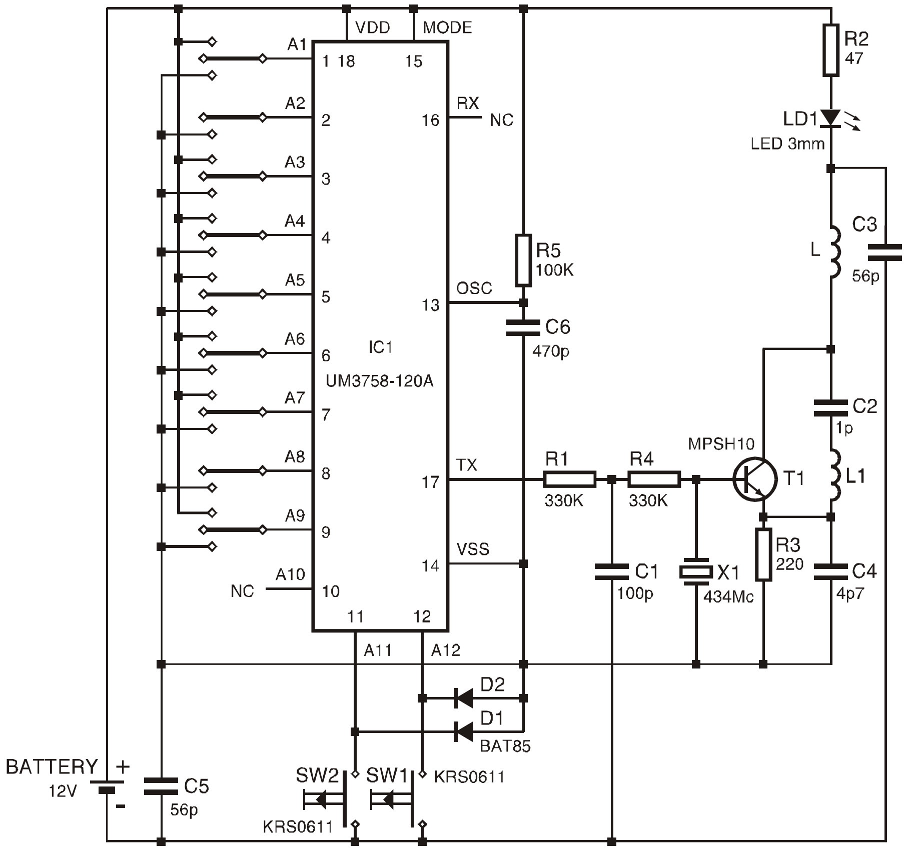
24. Transmitter PCB



Display PCB



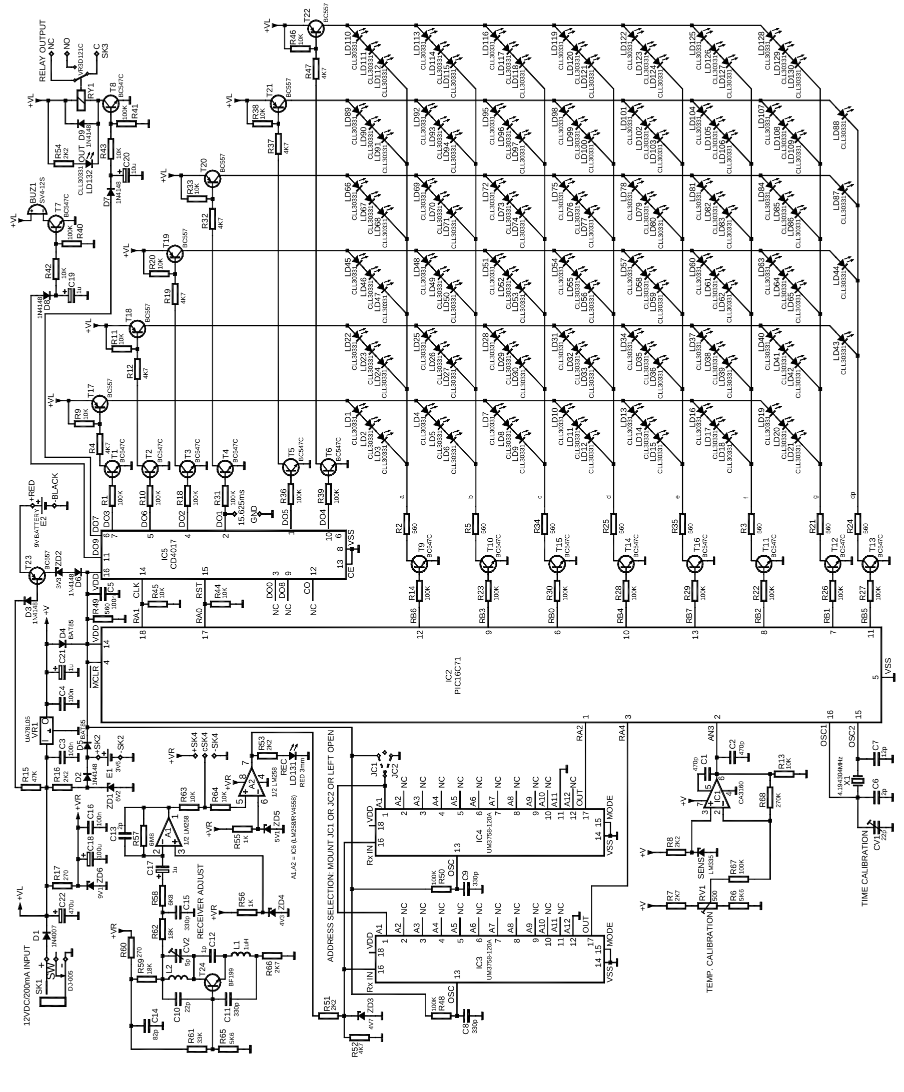
25. Transmitter diagram



modifications reserved

For use with old version of receiver K6707 replace C1 by 1pF on the receiver P.C.B. and readjust the receiver.

Display diagram



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Belgium Europe
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